

Appl. No. 10/612,859
Examiner: Thao P Le, Art Unit 2818
In response to the Office Action dated October 28, 2004

Date: January 27, 2005
Attorney Docket No. 10112421

REMARKS

Applicant thanks the Examiner for acknowledging Applicant's claim to foreign priority and receipt of the certified copy of the priority document. Responsive to the Office Action mailed on October 28, 2004 in the above-referenced application, Applicant respectfully requests amendment of the above-identified application in the manner identified above and that the patent be granted in view of the arguments presented. No new matter has been added by this amendment.

Present Status of Application

After this amendment, claims 1-4 and 6-26 are pending. Claims 1-4, 7-8, 11-17, and 19-22 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee (US 5,933,749). Claims 5-6, 9-10, 18, and 23-24 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee in view of Taiwan Patent No. 460974.

In this paper, claims 1 and 14 are amended. Support the amendments can be found on page 9, lines 11-30, page 10, lines, 1-2, and Figs. 4B-4D of the application. Claim 5 is canceled. New claims 25 and 26 are added by this amendment. Support for new claims 25 and 26 are disclosed in page 9, lines 11-21, and Fig. 4C of the application.

Reconsideration of this application is respectfully requested in light of the amendments and the remarks contained below.

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Rejections under 35 U.S.C. 103(a)

Claims 1-4, 7-8, 11-17, and 19-22 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee. To the extent that the grounds of the rejections may be applied to the claims now pending in this application, they are respectfully traversed.

Lee teaches a method for removing the top corner of a trench. In Lee, a mask 24, such as a photoresist layer, is formed onto a silicon nitride layer 22, wherein the openings of mask 24 are wider than the openings of the respective trenches 23. An isotropic dry etching is then performed to remove at least a portion of each of the silicon nitride layer 22 and at least a portion of the substrate uncovered by the mask 24. See column 2, lines 27-38 and Figs. 2b-2c of Lee.

Lee does not teach or suggest a method of forming shallow trench isolation with chamfered corners, comprising a steps of pulling back the second mask layer a predetermined distance by wet etching to expose the first mask layer adjacent to the trench and result in the second mask layer having a tapered profile; and etching the second mask layer, the first mask layer, the pad insulating layer, and the substrate along the tapered profile of the second mask layer by anisotropic etching to chamfer corners of the trench, as recited in claims 1 and 14.

MPEP 2142 reads in part:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the

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reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

In connection with the third criteria, MPEP 2143.03 goes on the state:

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

In the embodiments of the invention recited in claims 1 and 14, a method of forming a shallow trench isolation with chamfered corners comprises, *inter alia*, three separate etching steps. In the first etching step, the substrate is etched to form a trench with the patterned second mask layer as a mask. In the second etching step, the second mask layer is wet etched to pull the second mask layer back a predetermined distance from the trench resulting in the second mask layer having a tapered profile. Particularly, in order to maintain the first mask layer and the substrate, the method used for pulling back the second mask layer is wet etching. The second mask layer is etched at a faster rate than the first mask layer and the substrate and thus the first mask layer and the substrate are not affected by the wet etching, as acknowledged by the

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Examiner in section 5, paragraph 2, of the Office Action. In the third etching step, the second mask layer, the first mask layer, and the substrate are etched along the tapered profile of the second mask layer by anisotropic etching to chamfer corners of the trench.

Lee teaches a method for forming a top corner of a trench. As noted previously, Lee teaches forming a mask 24 onto a silicon nitride layer 22, wherein the openings of mask 24 are wider than the openings of the respective trenches 23. See Fig. 2b of Lee. Thus, Lee teaches directly forming a smaller patterned second mask to expose the first mask layer and the substrate. In contrast, claims 1 and 14 recite that the second mask layer is ***pulled back by wet etching*** to expose the first mask layer adjacent to the trench and result in the second mask layer having a ***tapered profile***.

Furthermore, Lee teaches performing an ***isotropic*** dry etching using the second mask layer as an etch mask, wherein the second mask layer has a vertical profile. In contrast, claims 1 and 14 recite ***anisotropically*** etching the second mask layer, the first mask layer, and the substrate ***along the tapered profile of the second mask layer***.

In the Office Action, it is acknowledged that Lee fails to disclose the step of forming a second mask prior to forming the trench and using the second mask to etch the trench. However, even given suggestions to form a second mask prior forming the trench, Applicant respectfully submits that there is no teaching or suggestion in Lee of the limitations of etching the second mask layer by wet etching to result in the second mask layer having a tapered profile, and then anisotropically etching the substrate along the tapered profile to a trench with chamfered corners.

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For at least these reasons, it is Applicant's belief that claims 1 and 14 are allowable over Lee. Insofar as claims 2-4 and 6-26 depend from either claims 1 or 14, it is Applicant's belief that these claims are also in condition for allowance.

Claims 5-6, 9-10, 18, and 23-24

Claims 5-6, 9-10, 18, and 23-24 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Lee in view of Taiwan Patent No. 460974. As noted above, it is Applicant's belief that that claims 5-6, 9-10, 18, and 23-24 are allowable by virtue of their dependency from claims 1 or 14. For this the reason, the Examiner's arguments in connection with these claims are considered moot and will not be addressed here.

Taiwan Patent No. 459339

Applicant submits that Taiwan Patent No. 459339 does not teach or suggest pulling back the second mask layer a predetermined distance by wet etching to expose the first mask layer adjacent to the trench and result in the second mask layer having a tapered profile; and etching the second mask layer, the first mask layer, the pad insulating layer, and the substrate along the tapered profile of the second mask layer by anisotropic etching to chamfer corners of the trench, as recited in claims 1 and 14.

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Conclusion

The Applicant believes that the application is now in condition for allowance and respectfully requests so.

Respectfully submitted,



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